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प्राकृतिक इमारती पत्थर का विशिष्ट घनत्व  
ज्ञात करना — परीक्षण पद्धति  
(दूसरा पुनरीक्षण)

**Determination of True Specific  
Gravity of Natural Building Stones —  
Method of Test**  
( Second Revision )

ICS 91.100.15

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## FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Stones Sectional Committee had been approved by the Civil Engineering Division Council.

Building stones are available in large quantities in various parts of the country in various geological horizons and to choose and utilize them for their satisfactory performance, it is necessary to know various strength properties determined according to standard procedure. This standard had, therefore, been formulated to cover the standard method for determining the specific gravity, apparent and true porosity of various stones.

This standard was first published in 1957 and subsequently revised in 1974. In the revision of 1974 only the property of true specific gravity was covered as apparent specific gravity and true porosity have been covered in IS 1124 : 1974 'Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones'. It was further clarified that the property of true specific gravity is generally not used for selecting stones for construction purposes and for this generally apparent specific gravity as covered in IS 1124 : 1974 is followed. However, for research work and also for certain specialized river valley projects where it is important to know the total porosity of stone, this property may be needed and hence it has been retained in this revision.

The major modifications incorporated in this revision are as follows:

- a) Constant mass has been defined;
- b) The sample size for use in the procedure for determining specific gravity has been modified;
- c) An alternative provision to the boiling of water during the procedure has been provided; and
- d) The calculation of the test results has been modified to reduce error.

This standard contributes to the United Nations Sustainable Development Goal 11 'Sustainable Cities and Communities' towards strengthening the efforts to protect and safeguard the world's cultural and natural heritage.

The composition of the Committee responsible for formulation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***DETERMINATION OF TRUE SPECIFIC GRAVITY OF  
NATURAL BUILDING STONES — METHOD OF TEST***( Second Revision )***1 SCOPE**

This standard lays down the procedure for determining true specific gravity of natural building and dimensional stones used for constructional purposes.

**2 SELECTION OF SAMPLE**

**2.1** The sample shall be selected to represent a true average of the type of stone under consideration.

**2.2** The sample shall be selected from the quarried stone or taken from the natural rock, as described in **2.2.1** and **2.2.2** and shall be of adequate size to permit the preparation of the requisite number of test pieces.

**2.2.1 Stones from Ledges or Quarries**

The ledge or quarry face of the stone shall be inspected to determine any variation in different strata. Differences in colour, texture and structure shall be observed. Separate samples of stone weighing at least 2.5 kg each of the unweathered specimens shall be obtained from all strata that appear to vary in colour, texture and structure. Pieces that have been damaged by blasting, driving wedges, heating, etc, shall not be included in the sample.

**2.2.2 Field Stone and Boulders**

A detailed inspection of stones and boulders over the area shall be made where the supply is to be obtained. The different kinds of stone and their condition at various quarry sites shall be recorded. Separate samples for each class of stone that would be considered for use in construction, as indicated by visual inspection shall be selected.

**2.3** When perceptible variations occur in the quality of rock, as many samples as are necessary for determining the range in properties shall be selected.

**3 TEST SAMPLE**

**3.1** From the specimen as selected in **2**, take 0.5 kg of stone. Thoroughly wash to remove dust and other coatings from surface and dry the pieces. Crush the pieces between hardened steel surfaces to a

maximum of 3 mm size particles, thoroughly mix and reduce to a test sample of 100 g.

**3.2** The entire 100 g sample shall be ground in an agate mortar to such fineness that it will pass 150 micron IS Sieve. Any magnetic material introduced in crushing or grinding shall be removed by a magnet.

**4 APPARATUS****4.1 Analytical Balance and Weight**

**4.2 Specific Gravity Bottle** — 50 ml with capillary tube stopper.

**4.3 Thermometer****4.4 Drying Oven****4.5 Weighing Bottle and Desiccator****5 PROCEDURE**

**5.1** The 100 g sample shall be placed in a weighing bottle and dried to a constant mass such that two consecutive mass measurements taken at an interval of 2 h shall not vary by 0.05 percent at 105 °C to 110 °C, and cooled in a desiccator.

**5.2** The specific gravity bottle with the stopper shall be cleaned, washed and dried to constant mass at 105 °C to 110 °C such that two consecutive mass measurements taken at an interval of 2 h shall not vary by 0.05 percent and cooled in a desiccator and weighed in an analytical balance ( $W_1$ ).

**5.2.1** The stopper of the specific gravity bottle shall be removed and about 25 g of the dried stone powder from the weighing bottle shall be introduced in the bottle. The bottle shall be closed with the stopper and weighed with the sample ( $W_2$ ). The stopper shall be removed again and distilled water shall be poured to fill the bottle to about three-fourth of its volume. Entrapped air shall be removed by boiling gently the contents of the bottle for at least 10 min while occasionally rolling the bottle to assist in the removal of the air. The bottle shall then be cooled to room temperature and then filled fully with distilled water, stoppered and then outside of the bottle cleaned and dried with a clean dry cloth. The

bottle with its stopper and contents shall then be weighed ( $W_3$ ). The bottle shall then be emptied, cleaned and washed. It shall then be filled fully with distilled water, stoppered and weighed at room temperature ( $W_4$ ).

It is better to test at defined temperature of  $27\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . If test is not carried out at defined temperature, reading of water temperature shall be taken at every stage of weighing and they should be within  $\pm 1\text{ }^{\circ}\text{C}$ .

NOTE — As an alternative to boiling, a vacuum of 20 mm to 30 mm of Hg for 1h may be applied for removing entrapped air.

**5.2.2** The average of the three measurements shall be taken and all three may be reported.

## 6 EVALUATION AND REPORTING

**6.1** The true specific gravity shall be calculated from the following formula:

$$\text{True specific gravity, at } t\text{ }^{\circ}\text{C} = \frac{W_2 - W_1}{(W_4 - W_1) - (W_3 - W_2)}$$

where

- $t$  = room/defined temperature ( $27\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ );
- $W_1$  = mass, in g, of the empty specific gravity bottle with stopper;
- $W_2$  = mass, in g, of the bottle with stopper and powder;
- $W_3$  = mass, in g, of the bottle with stopper, powder and distilled water to fill rest of the bottle at room/defined temperature; and
- $W_4$  = mass, in g, of the bottle with stopper filled with distilled water at room/defined temperature;

**6.2** The true specific gravity shall be expressed as a numerical value and shall be based on average of three determinations. Individual readings shall not differ by more than 0.05, failing which, additional tests may be carried out as required and the average of 3 valid results shall be reported to three significant figures.

**6.3** Identification of the sample, date when sample was taken and type of stone shall be reported along with the true specific gravity of the sample.

**ANNEX A***(Foreword)***COMMITTEE COMPOSITION**

Stones Sectional Committee, CED 06

<i>Organization</i>	<i>Representative(s)</i>
Indian Institute of Technology Delhi, New Delhi	DR SHASHANK BISHNOI ( <b>Chairperson</b> )
Central Public Works Department, New Delhi	SHRI M. K. MALLICK
Central Soil and Materials Research Station, New Delhi	SHRI U. S. VIDYARTHI SHRI SACHIN GUPTA ( <i>Alternate</i> )
Centre for Development of Stones, Jaipur	SHRI MUKUL RASTOGI
CSIR - Central Building Research Institute, Roorkee	DR ACHAL MITTAL DR RAJNI LAKHANI ( <i>Alternate</i> )
Development and Research Organization for Nature, Arts and Heritage, Gurugram	SHRI SANJAY DHAR
Directorate of Geology and Mining, Lucknow	SHRI NAVEEN KUMAR DAS SHRI R. P. SINGH ( <i>Alternate</i> )
Federation of Indian Granite & Stone Industry, Bengaluru	REPRESENTATIVE
Geological Survey of India, Kolkata	SHRI DHRUBAJYOTI CHAKRABORTY SHRI RABISANKAR KARMAKAR ( <i>Alternate</i> )
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Indian Bureau of Mines, Nagpur	SHRI G. C. MEENA
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Jaipur Metro Rail Corporation Limited, Jaipur	REPRESENTATIVE
Malaviya National Institute of Technology, Jaipur	DR A. K. VYAS DR R. C. GUPTA ( <i>Alternate</i> )
National Council for Cement and Building Materials, Ballabgarh	DR D. K. PANDA SHRI SANDEEP GUPTA ( <i>Alternate</i> )
National Institute of Rock Mechanics, Ministry of Mines, Govt of India, Kolar	DR A. RAJAN BABU SHRI G. C. NAVEEN ( <i>Alternate</i> )

<i>Organization</i>	<i>Representative(s)</i>
National Institute of Technology Calicut, Kozhikode	DR A. K. KASTURBA DR JAYA CHANDRAN K. ( <i>Alternate</i> )
Public Works Department, Government of Tamil Nadu, Chennai	SUPERINTENDING ENGINEER EXECUTIVE ENGINEER (GENERAL) ( <i>Alternate</i> )
School of Planning and Architecture, New Delhi	HEAD OF DEPARTMENT SHRI SHUVOJIT SARKAR ( <i>Alternate I</i> ) SHRI MEHAR KUMAR ( <i>Alternate II</i> )
Shriram Institute for Industrial Research, New Delhi	DR MUKESH GARG SHRI RAMAN DHYANI ( <i>Alternate</i> )
Stone Technology Centre, Jaipur	SHRI K. VIKRAM RASTOGI SHRI VIKRANT V. RASTOGI ( <i>Alternate</i> )
Tamil Nadu Minerals Limited, Chennai	REPRESENTATIVE
The Indian Institute of Architects, Mumbai	SHRI DIVYA KUSH SHRI AJAY PURI ( <i>Alternate</i> )
The Institution of Engineers, Kolkata	SHRI V. K. GUPTA DR A. GOEL ( <i>Alternate</i> )
Unique Engineering Testing and Advisory Services, Surat	SHRI HITESH H. DESAI SHRI NEHAL H. DESAI ( <i>Alternate</i> )
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